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10/683,534	10/10/2003	Lawrence S. Melvin III	SNPS-0524	2616

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EXAMINER	
PIERRE LOUIS, ANDRE	

ART UNIT	PAPER NUMBER
2123	

MAIL DATE	DELIVERY MODE
05/15/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/683,534	**Applicant(s)** MELVIN, LAWRENCE S.	
	Examiner Andre Pierre-Louis	**Art Unit** 2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _14 March 2007_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-35_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-35_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/14/2007 has been entered.

2. Claims 1-35 are presented for examination.

3. With regards to the objections to the claims, the examiner withdraws the objection in view of the amendment.

4. Regarding the rejection under 35USC 101, the examiner withdraws the rejection of the claims in view of the amendment.

Response to Arguments

5. Applicant's arguments filed 03/14/2007 have been fully considered but they are moot in view of the new ground of rejection.

5.1 Applicant argues that Pierrat does not teaches generating intensity gradients with both magnitude and angle, the Examiner has brought in a new reference to cover the argued part of the claims.

5.2 While the applicant believes that the independent claims, along with the dependent claims should be found allowable, the examiner respectfully disagrees and asserts that the combined references cited teach the entire claimed invention. Applicant is further encouraged to look at the new references not used shown in the conclusion section below. However, the grounds of rejections below fully support the Examiner's position in rejecting the instant claims.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6.0 Claims 1-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhang et al. (USPG_PUB No. 2003/0061587), in view of Shi et al. (U.S. Patent No. 6,519,760), and further in view of Pierrat et al. (U.S. Patent No. 6,453,457).

6.1 In considering the independent claims 1,12,23,34, and 35, Zhang et al. substantially teaches a method for dissecting a layout of an integrated circuit based on modeled intensity gradients to produce a segmentation for an optical proximity correction (OPC) process, and particularly teaches the steps of: receiving the layout for the integrated circuit *(fig.5 (502) pg.3 (0048-0049))*; generating a segmentation for edges in the layout based upon the intensity gradients, wherein the segmentation is used by a subsequent OPC process in generating corrections for the layout *(see fig.5 (506), para 0029-0034);*however, he does not clearly teaches the step of performing a model-based simulation on the layout to generate intensity gradients along edges of features in the layout, wherein the intensity gradients include both magnitude and angle and wherein an intensity gradient angle can be in any direction with respect to an angle; Shi et al. substantially teaches the step of performing a model-based simulation on the layout to generate intensity gradients along edges of features in the layout, wherein the intensity gradients include both magnitude and angle and wherein an intensity gradient angle can be in any direction with respect to an angle *(see fig.1,3,5, and 12 and col.8 lines 24-64, col.3 lines 52-54)*; but they do not expressly teaches wherein the OPC correct layout is used to generate a mask for fabricating an integrated circuit. *Pierrat et al. substantially* teaches wherein the OPC correct layout is used to generate a mask for fabricating an integrated circuit (*fig.2-3, col.8 lines 30-50*). The examiner asserts that the correction is applied using the rule-based teaches by Pierrat et al.; however, Zhang et al. teaches biasing an edge (*fig.5 (516)*) and updated layout at step 520 in fig.5. and that Zhang et al. teaches performing both rule-based and model-based proximity correction and output a circuit layout with optical proximity correction (*see para 0013-0018*). Shi et al. further teaches an exemplary mask pattern to be printed on a wafer *(see fig.2)*. Zhang, Shi et al., and Pierrat et al. are analogous art because they are from the same field of endeavor and that the model analyzes by Shi et al. and Pierrat et al. is similar to that of Zhang et al. Therefore, it would have been obvious to one ordinary skilled in the art at the time of the applicant invention to combine the method and apparatus of Shi et al. and the mask fabrication techniques of Pierrat et al. with the method and apparatus of Zhang et al. because Shi et al. teaches a simulation result that provides an overall better process with the advantage of the assist feature benefit *(col.11 lines 60-63)* and Pierrat et al. teaches the advantage of using previously computed model runs to analyze differences after the edges get dissected and the advantage of customizing the dissection for certain important edges and responding to the actual variation of proximity affects (*see col.21 lines 3-26)*.

6.2 As per claims 2,13, and 24, the combined teachings of Zhang et al., Shi et al. and Pierrat et al. substantially teach that the step of generating the segmentation involves: determining segment lengths for edges in the layout based upon the intensity gradients along the edges *(see Zhang et al. fig.4-5, pg.2 (0029-0034), also see Pierrat et al. fig.9, col.20 lines 59-*

67); and using the segment lengths to dissect the edges in the layout, thereby generating the segmentation for the layout *(see Zhang et al. fig.5, pg.3-4 (0048-0059), also see Pierrat et al. fig. 9).*

6.3 With regards to claims 3,14, and 25, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach that identifying a segment length for an edge involves using a predetermined association to map an intensity gradient angle to the segment length *(see Zhang et al. fig.4-5, pg.2-3 (0029-0034 and 0048-0059)).*

6.4 Regarding claims 4,15, and 26, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach that generating the segmentation involves selecting a segmentation for a line-end in the layout from a set of predetermined line-end segmentations based upon intensity gradients associated with the line-end *(see Zhang et al. fig.5.(510), pg.3 (0048-0059 and 0039-0040), also see Pierrat et al. fig.9).*

6.5 As per claims 5,16, and 27, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach that the segmentation for the line-end is selected based upon a magnitude of an intensity gradient associated with the line-end *(see Zhang et al. fig.4-5, pg.1-2 (0009-0012 and 0030-0034)).*

6.6 With regards to claims 6,17, and 28, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach that performing the model-based simulation on the layout involves: dividing each edge in the layout into minimum-sized segments *(see Zhang et al. fig.4-5, pg.1-2 (0009-0011 and 0030), also see Pierrat et al. col.5 line 31-col.6 line 42)*; and performing a model-based simulation to determine an intensity gradient for each minimum-sized segment *(see Zhang et al. fig.4-5, pg.1-2 (0009-0012 and 0030-0034), also see Pierrat et al. fig. 3-5).*

6.7 Regarding claims 7,18, and 29, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach that determining a gradient for a given minimum-sized segment involves performing a model-based simulation at two tangential points along the segment to determine a tangential component of the gradient *(see Zhang et al. fig.5, pg.3 (0048-0059), also see Pierrat et al. fig.3, 7 &9).*

6.8 As per claims 8,19, and 30, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach that determining the gradient for the given minimum-sized segment involves performing a model-based simulation at two points along a normal to the segment to determine a normal component of the gradient *(see Zhang et al. fig.4-5, pg.3 (0048-0059), also see Pierrat et al. fig.3, 7 & 9).*

6.9 With regards to claims 9,20, and 31, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach the step performing the dissection again on problem areas in the layout after initial OPC operations take place *(see Zhang et al. fig.5, para (0042-0045 & 0054), also see Pierrat col.26 lines 18-44).*

6.10 Regarding claims 10,21, and 32, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach the step reducing the number of segments in areas that prove to be simpler to correct than predicted after initial OPC operations take place *(see Zhang et al. fig.4-5, pg.1-2 (0002-0012 and pg.3 (0048-0059)).*

6.11 As per claims 11,22,33, the combined teachings of Zhang et al., Shi et al., and Pierrat et al. substantially teach prior to receiving the layout, the method further comprises calibrating the association between gradients and segment lengths by: modeling an intensity gradient across a test pattern *(see Pierrat et al. fig.6-7, col.15 lines 8-67, also see Zhang et al. fig.4-5*; identifying target regions in the test pattern that have a large amount of correction shift variation *(see Pierrat et al. fig.5, col.5 lines 8-col.6 line 42 & see Zhang et al. pg.3 (0030-0034));* mapping intensity gradients to the target regions *(see Pierrat et al. fig.5, col.5 lines 8-col.6 line 42 & see Zhang et al. pg.3 (0030-0034));* associating segment lengths with the target regions *(see Pierrat et al. fig.5, col.5 lines 8-col.6 line 42 & see Zhang et al. pg.3 (0030-0034));* and producing an association between intensity gradients and segment lengths in the target regions, whereby the association is subsequently used in generating the segmentation for the layout *(see Pierrat et al. fig.5, col.5 lines 8-col.6 line 42 & see Zhang et al. pg.3 (0030-0034))*.

7. Claims 1,12,23,34, and 35 are further rejected under 35 U.S.C. 103(a) as being unpatentable over Pierrat (U.S. Patent No. 7,010,764), in view of Shi et al. (U.S. Patent No. 6,519,760).

7.1 Regarding claims 1,12,23,34, and 35, Pierrat '764 substantially teaches a method for dissecting a layout of an integrated circuit based on modeled intensity gradients to produce a segmentation for an optical proximity correction (OPC) process, and particularly teaches the steps of: receiving the layout for the integrated circuit *(see fig.17 (1701)*; performing a model-based simulation on the layout to generate intensity gradients along edges of features in the layout, wherein the intensity gradients include both magnitude and angle and wherein an intensity gradient angle can be in any direction with respect to an angle *(fig.6-9,11,17, col.5 line 21-col.6 line 31)*; and generating a segmentation for edges in the layout based upon the intensity gradients, wherein the segmentation is used by a subsequent OPC process in generating corrections for the layout *(see col.5 line 21-col.6 line 67);* wherein the OPC correct layout is used to generate a mask for fabricating an integrated circuit (*see fig.17 (1706)).* Although Pierrat '764 does not state the exact term that the intensity gradient includes magnitude and angle, Pierrat '764 *fig.5-9, 11* show many figures with intensity gradient having both magnitude and angles (see for example ϒ, θ and arrows 803,904, which the examiner considers to a substantial equivalence of the gradient magnitude and angle claimed. Nevertheless, Shi et al. substantially teaches generate intensity gradients along edges that include both magnitude and angle *(see fig.1, 3,5, and 12 and col.8 lines 24-64, col.3 lines 52-54).* Pierrat '764 and Shi et al. are analogous art because they are from the same field of endeavor and that the model analyzes by Shi et al. is similar to that of Pierrat '764. Therefore, it would have been obvious to one ordinary skilled in the art at the time of the applicant invention to combine the method and apparatus of Shi et al. with the method and apparatus of Zhang et al. because Shi et al. teaches a simulation result that provides an overall better process with the advantage of the assist feature benefit *(col.11 lines 60-63).*

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

8.1 Melvin III et al. (Model-based methodology for reducing OPC output pattern complexity, SPIE 2003).

8.2 Fanget et al. (Adjustment of Optical Proximity Correction (OPC) Software for Mask Process Correction (MPC), October 2001).

9. Claims 1-35 are rejected and **THIS ACTION IS Non-FINAL**. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andre Pierre-Louis whose telephone number is 571-272-8636. The examiner can normally be reached on Mon-Fri, 8:00AM-4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul L. Rodriguez can be reached on 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

May 12, 2007

APL

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